

## CLAIMS

What is claimed is:

- 1     1.     In a computer system having I/O components and a file system existing within a volume  
2     group comprised of storage media, a method for substantially preventing I/O failure due to  
3     insufficient storage space within the file system, said method comprising:  
4         determining that a received I/O operation directed at said file system requires more storage  
5     space than is currently available within said file system;  
6         dynamically expanding the storage space available within said file system to accommodate  
7     said I/O operation, wherein additional space on said volume group is allocated to said file  
8     system; and  
9         subsequently completing said I/O operation within said file system;  
10        wherein said dynamically expanding step and said subsequently completing step are both  
11    completed without user input and/or activation.
- 1     2.     The method of Claim 1, wherein said dynamically expanding step includes assigning  
2     reserve storage space existing within said volume group to a logical volume hosting said file  
3     system.
- 1     3.     The method of Claim 1, wherein said subsequently completing step comprises restarting  
2     said I/O operation within kernel space without requiring user input.
- 1     4.     The method of Claim 1, further comprising issuing a notification indicating that said  
2     dynamically expanding step is being completed.
- 1     5.     The method of Claim 1, further comprising:  
2         signaling a logical volume manager (LVM) of a need for additional storage space for  
3     completing said I/O;

4 completing an automatic expansion of a logical volume hosting said file system, wherein  
5 said dynamically expanding step expands said file system into available space within said logical  
6 volume following said automatic expansion.

1 6. The method of Claim 5, wherein said signaling step is completed via an I/O failure  
2 response (FR) daemon that coordinates communication between control blocks in the kernel  
3 space and the LVM.

1 7. The method of Claim 1, wherein said determining step comprises:  
2 parsing parameters from said I/O command for a size of said storage space required to  
3 complete said I/O operation; and  
4 comparing said storage space with an available storage space size within said file system.

1 8. The method of Claim 1, wherein said dynamically expanding step comprises:  
2 determining that said storage space is available within said reserve space; and  
3 expanding said file system to include a preset amount of space from said reserve space.

1 9. The method of Claim 5, wherein said expanding step includes iteratively expanding said  
2 file system by said preset amount of space until a total space within said file system is sufficient  
3 to accommodate said I/O operation.

1 10. The method of Claim 1, wherein said dynamically expanding step comprises:  
2 calculating an amount of additional space required to complete said I/O, with  
3 consideration of currently available space within said file system ; and  
4 dynamically expanding said file system by at least said amount of additional space  
5 required.

1 11. In a computer system having I/O components and a file system existing within a volume  
2 group comprised of storage media, a system for mitigating I/O failure due to insufficient storage  
3 space within the file system, said system comprising:

4 means for determining that a received I/O operation directed at said file system requires  
5 more storage space than is currently available within said file system;  
6 means for dynamically expanding the storage space available within said file system to  
7 accommodate said I/O operation, wherein additional space on said volume group is allocated to  
8 said file system; and  
9 means for subsequently completing said I/O operation within said file system;  
10 wherein said means for dynamically expanding and said means for subsequently  
11 completing both initiate without user input and/or activation.

1 12. The system of Claim 11, wherein:  
2 said means for dynamically expanding includes means for assigning reserve storage  
3 space existing within said volume group to a logical volume hosting said file system; and  
4 said means for subsequently completing comprises means for restarting said I/O  
5 operation within kernel space without requiring user input.

1 13. The system of Claim 11, further comprising means for issuing a notification indicating  
2 that said dynamically expanding step is being completed.

1 14. The system of Claim 11, further comprising:  
2 means for signaling a logical volume manager (LVM) of a need for additional storage  
3 space for completing said I/O; and  
4 means for enabling said LVM to complete an automatic expansion of a logical volume  
5 hosting the file system, wherein said LVM signals said file system of a completion of said  
6 automatic expansion.

1 15. The system of Claim 11, further comprising an I/O failure response (FR) daemon that  
2 coordinates communication between control blocks in the kernel space and the LVM.

1 16. The system of Claim 11, wherein said means for dynamically expanding comprises:  
2 means for determining that said storage space is available within said reserve space; and

3 means for expanding said file system to include a preset amount of space from said  
4 reserve space, wherein said means for expanding reiteratively expands said file system by said  
5 preset amount of space until a total space within said file system is sufficient to accommodate  
6 said I/O operation.

1 17. The system of Claim 11, wherein said dynamically expanding step comprises:  
2 means for calculating an amount of space required to complete said I/O given a value of  
3 currently available space within said file system ; and  
4 means for dynamically expanding said file system by at least said amount of space  
5 required.

1 18. The system of Claim 11, wherein:  
2 said means for determining includes I/O CC and OS functional logic;  
3 said means for dynamically expanding includes said LVM; and  
4 said means for notifying includes an I/O FR daemon that bridges communication between  
5 said I/O CC at an OS level and said LVM at an application level within said computer system.

1 19. A computer program product comprising:  
2 a computer readable medium; and  
3 computer program code on said computer readable medium for substantially preventing  
4 I/O failure due to storage space restrictions within a file system, said program code further  
5 comprising code for:  
6 determining that a received I/O operation directed at said file system requires more  
7 storage space than is currently available within said file system;  
8 dynamically expanding the storage space available within said file system to  
9 accommodate said I/O operation, wherein additional space on said volume group is allocated to  
10 said file system; and  
11 subsequently completing said I/O operation within said file system.

1 20. The computer program product of Claim 19, further comprising code for:

2            assigning reserve storage space existing within said volume group to a logical volume  
3            hosting said file system; and  
4            restarting said I/O operation within kernel space without requiring user input;  
5            wherein said code for implementing said dynamically expanding step and said  
6            subsequently completing step are executed without user input and/or activation..

1    21.    The computer program product of Claim 19, further comprising code for:

2            implementing an I/O failure response (FR) daemon that coordinates communication  
3            between control blocks in the kernel space and the LVM, wherein said I/O FR completes a set of  
4            functional operations including:

5                    signaling a logical volume manager (LVM) of a need for additional storage space  
6                    for completing said I/O;

7                    issuing a notification indicating that said dynamically expanding step is being  
8                    completed; and

9                    initiating a restart of said I/O operation once said expansion completes;

10            wherein said LVM completes an automatic expansion of a logical volume hosting  
11            said file system, and said dynamically expanding step expands said file system into  
12            available space within said logical volume following said automatic expansion.

1    22.    The computer program product of Claim 19, wherein said code for determining  
2            comprises additional code for:

3            parsing parameters from said I/O command for a storage space required to complete said  
4            I/O operation; and

5            comparing said storage space with an available storage space within said file system.

1    23.    The computer program product of Claim 19, wherein said code for dynamically  
2            expanding comprises code for:

3            determining that said storage space is available within said reserve space;

4            expanding said file system to include a preset amount of space from said reserve space;

5            and

6 iteratively expanding said file system by said preset amount of space until a total space  
7 within said file system is sufficient to accommodate said I/O operation.

1 24. The computer program product of Claim 19, wherein when there is not sufficient space  
2 within said reserve space, said code comprises additional code for signaling a complete failure of  
3 said I/O operation.

1 25. The computer program product of Claim 16, wherein said code for dynamically  
2 expanding step comprises:  
3 code for calculating an amount of space required to complete said I/O given a value of  
4 currently available space within said file system ; and  
5 code for dynamically expanding said file system by at least said amount of space  
6 required.